Atty. Docket #: 0732/990022
(Basell-4)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

INTERNATIONAL APPL. NO.: PCT/EP00/03315	:	
INTERNATIONAL FILING DATE: -04/13/2000-	:	
APPLICANT: JÖRG SCHOTTEK ET AL	:	
SERIAL NO: (To be assigned)	:	**ART UNIT:**
FILED: -HEREWITH-	:	**EXAMINER:**
FOR: "CHEMICAL COMPOUND, ITS PREPARATION AND ITS USE IN A CATALYST SYSTEM FOR PREPARING POLYOLEFINS"	:	

Commissioner for Patents
Box PCT
Washington, D.C. 20231

"Express Mail" No.: ET481431582 Date: -OCTOBER 19, 2001-

I hereby certify that this paper, along with any other paper or fee referred to in this paper as being transmitted herewith, is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10, postage prepaid, on the date indicated above, addressed to the Commissioner for Patents, Washington, D.C. 20231

- Carrie A. McPherson -
(Typed or printed name of mailing paper or fee)

Carrie A. McPherson
(Signature of person mailing paper)

TRANSMITTAL OF APPLICATION PAPERS TO U.S. DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. §371 (37 CFR 1.494 OR 1.495)

This Transmittal Letter is based upon PTO Form 1390 (as revised in May, 1993).

The above-identified applicant(s) (jointly with their assignee) have filed an International Application under the P.C.T. and hereby submit(s) to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

International Application No. PCT/EP00/03315

0732/990022
(Basel1-4)

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. §371.

2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. §371.

3. [X] This is an express request to begin national examination procedures (35 U.S.C. §371[f]) at any time rather than delay.

4. [X] A proper Demand for International Preliminary Examination (IPE) was made to the appropriate Authority (IPEA) within the time period required.

5. [X] A copy of the International Application as filed (35 U.S.C. §371[c][2]) --
   a. [ ] is transmitted herewith (required when not transmitted by International Bureau).
   b. [X] has been transmitted by the International Bureau. See WIPO Publication WO 00/64906.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).

6. [X] A (verified) translation of the International Application into the English language is enclosed.

7. [X] Amendments to the (specification and) claims of the International Application under PCT Article 19 (35 U.S.C. 371[c][3])
   a. [X] are transmitted herewith (required if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. [ ] have not been made and will not be made.
   e. [ ] will be submitted with the appropriate surcharge.

8. [X] A translation of the amendments to the claims (and/or the specification) under PCT Article 19 (35 U.S.C. §371[c][3]) is enclosed or will be submitted with the appropriate surcharge.

9. [X] An unexecuted oath or declaration/power of attorney of the inventor(s) (35 U.S.C. §371[c][4]) is enclosed
   [X] and is attached to the translation of (or a copy of) the International Application.
   [ ] and is attached to the substitute specification.

10. [ ] A translation of at least the Annexes to the IPE Report under PCT Article 36 (35 U.S.C. §371[c][5]) is enclosed.

Items 11. to 16. below concern other document(s) or information included:

11. [x] An Information Disclosure Statement under 37 CFR 1.97 and 1.98 is enclosed.

12. [x] An Assignment is enclosed for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [x] A FIRST preliminary amendment is enclosed.
    A SECOND or SUBSEQUENT preliminary amendment is enclosed.

14. [ ] A substitute specification (including claims, abstract, drawing) is enclosed.

15. [ ] A change of power of attorney and/or address letter is enclosed.

16. [x] Other items of information:

    [X] This application is being filed pursuant to 37 CFR 1.494(c) or 1.495(c), and any missing parts will be filed before expiration of--

        [ ] 22 months from the priority date under 37 CFR 1.494(c), or

        [X] 32 months from the priority date under 37 CFR 1.495(c).

    [ ] The undersigned attorney is authorized by the International applicant and by the inventors to enter the National Phase pursuant to 37 CFR 1.494(c) or 1.495(c).

The following additional information relates to the International Application:

International Application No. PCT/EP00/03315

0732/990022
(Basell-4)

[X] Receiving Office: EPO
[X] IPEA (if filing under 37 CFR 1.495): EPO
[X] Priority Claim(s) (35 USC §§ 119, 365):
German Appln. 199 17 984.0 filed April 21, 1999.
[X] A copy of the International Search Report is

[ ] enclosed.
[X] attached to the copy of the International Application.

[X] A copy of the Receiving Office Request Form is enclosed.
[X] Form PTO/SB/05 (1) sheet
[X] Form PCT/ISA/220 - PCT Publication w/Search Report (8) pages
[X] Verification of Translation of new pages 58-59 (claims 1-6) (3) sheets
[X] Form PCT/IPEA/416 & 409 In German (8) pages

The fee calculation is set forth on the next page of this Transmittal Letter.

FEE CALCULATION SHEET

[x] A check in payment of the filing fee, calculated as follows, is attached (37 CFR 1.492).

Basic Fee.....	$ 890.00
Total Number of claims in excess of (20) times $18.....	-0-
Number of independent claims in excess of (3) times $84..... 5	168.00
Fee for multiple dependent claims $280.....	-0-
TOTAL FILING FEE...	168.00 $ 890.00 1.058.00

Kindly send us the official filing receipt.

The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Deposit Account No. 03-2775. This is a "general authorization" under 37 CFR 1.25(b), except that no automatic debit of the issue upon allowance is authorized. An additional copy of this page is attached.

Respectfully submitted,

By _____
Ashley I. Pezzner
Reg. No. 35,646
CONNOLLY BOVE LODGE & HUTZ LLP
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P.O. Box 2207
Wilmington, Delaware 19899
Tel. (302) 658-9141

AIP/cam (9086*178)
Enclosures
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10/030299
JC13 Rec'd PCT/PTO 20 OCT 2001

Please type a plus sign (+) inside this box → [+]

PTO/SB/05 (4/98)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	0732/990022 (Basell-4)
First Inventor or Application Identifier	JORG SCHOTTEK ET AL
Title	CHEMICAL COMPOUND, ITS PREPARATION AND..
Express Mail Label No.	ET481431582

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [X] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [X] Specification [Total Pages 60] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [ ] Drawing(s) *(35 U.S.C. 113)* [Total Sheets 0]
4. Oath or Declaration [Total Pages 3]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

*NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [X] Assignment Papers (cover sheet & document(s))
8. [X] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [X] Power of Attorney (unrevocated)
9. [X] English Translation Document *(if applicable)*
10. [X] Information Disclosure Statement (IDS)/PTO-1449 [X] Copies of IDS Citations
11. [X] Preliminary Amendment
12. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [ ] * Small Entity Statement(s) [ ] Statement filed in prior application, Status still proper and desired *(PTO/SB/09-12)*
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [X] Other: Form PCT/ISA/220 (8)pages
16. [X] Form PCT/IPEA/416 & 409 (8)pps
17. X Verification of Translation of new pages 58-59 (Claims 1-6) 3pps

16. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____/_____

Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or [X] *Correspondence address below*

Name	Ashley I. Pezzner, Esquire				
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Name (Print/Type)	ASHLEY I. PEZZNER	Registration No. (Attorney/Agent)	35,646
Signature	Ashley I. Pezzner	Date	OCT. 19, 2001

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

20541-6502 DOCKET

ATTORNEY DOCKET NO.: BASELL-4 (9086*178)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: JÖRG SCHOTTEK *ET AL.*	
SERIAL NO. TO BE ASSIGNED	ART UNIT: TO BE ASSIGNED
FILED: HEREWITH	EXAMINER: TO BE ASSIGNED
FOR: CHEMICAL COMPOUND, ITS PREPARATION AND ITS USE IN A CATALYST SYSTEM FOR PREPARING POLYOLEFINS	

Asst. Commissioner for Patents
Washington, D.C. 20231

"EXPRESS MAIL" NO. ET481431582 DATE: OCTOBER 19, 2001
I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED AND IS ADDRESSED TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231

CARRIE A. MCPHERSON (TYPED OR PRINTED NAME OF PERSON MAILING PAPER OR FEE)

Carrie A McPherson (SIGNATURE OF PERSON MAILING PAPER OR FEE)

PRELIMINARY AMENDMENT

Sir:

Prior to fee calculation and examination please amend the above-identified application as follows.

In the Claims

Please cancel claims 1-6.

Please add the following new claims.

- -7. A compound of the formula (I),

$$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k \quad (I)$$

wherein

R^1 and R^2 are identical or different and are each C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl or C_7-C_{40}-haloalkylaryl,

R^3 is a hydrogen atom, a halogen atom, C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group VIa of the Periodic Table of the Elements or an NH group,

M^1 is boron and

k is a natural number from 1 to 100.

8. The compound as claimed in claim 7, wherein X is an oxygen atom or an NH group.

9. A compound of the formula (I),

$$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k \quad (I)$$

wherein

R^1 and R^2 are identical or different and are each C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl or C_7-C_{40}-haloalkylaryl,

R^3 is a hydrogen atom, a halogen atom, C_2-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group VIa of the Periodic Table of the Elements or an NH group,

M^1 is an element of group IIIa of the Periodic Table of the Elements and

k is a natural number from 1 to 100.

10. The compound as claimed in claim 9, wherein X is an oxygen atom or an NH group and M^1 is aluminum or boron.

11. A process for preparing a compound of the formula (I)

$$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k \qquad (I)$$

wherein

R^1 and R^2 are identical or different and are each C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl or C_7-C_{40}-haloalkylaryl,

R^3 is a hydrogen atom, a halogen atom, C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group VIa of the Periodic Table of the Elements or an NH group,

M^1 is an element of group IIIa of the Periodic Table of the Elements and

k is a natural number from 1 to 100

which comprises reacting one or more compounds of the formula (II)

$$(R^5)_3Y \qquad (II)$$

wherein

R^5 is a hydrogen atom or C_1-C_{20}-alkyl, C_6-C_{20}-aryl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or a halogen atom,

and

Y is boron or aluminum,

with one or more compounds of the formula (III)

$(R^6)\ X'\ (R^1)$ (III)

wherein

R^1 is as above,

X' is an oxygen atom, a sulfur atom or an NH group, and

R^6 is hydrogen.

12. The process as claimed in claim 11, wherein M^1 and Y are boron.

13. The process as claimed in claim 11, wherein R^3 is a hydrogen atom, a halogen atom, C_2-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group.

14. The process as claimed in claim 11, wherein X' is an oxygen atom or an NH group.

15. A catalyst system comprising

A) at least one chemical compound formula (I)

$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k$ (I)

wherein

R^1 and R^2 are identical or different and are each C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl or C_7-C_{40}-haloalkylaryl,

R^3 is a hydrogen atom, a halogen atom, C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-

arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group VIa of the Periodic Table of the Elements or an NH group,

M^1 is an element of group IIIa of the Periodic Table of the Elements and

k is a natural number from 1 to 100, and

B) at least one transition metal compound which constitutes a metallocene compound, a diamine complex of transition groups III and IV of the Periodic Table of the Elements, a diimine complex of transition group VIII of the Periodic Table of the Elements or a 2,6-bis(imino)pyridine complex of transition group VIII of the Periodic Table of the Elements.

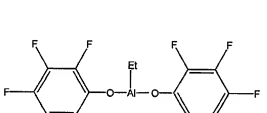
16. The catalyst system as claimed in claim 15, which further comprises a support.

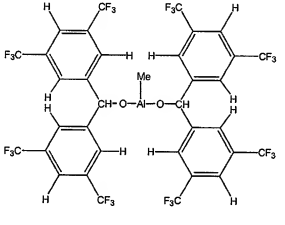
17. The catalyst system as claimed in claim 15, wherein M^1 is boron.

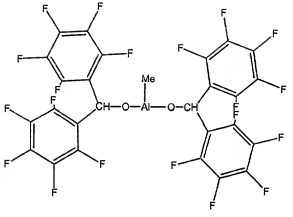
18. The catalyst system as claimed in claim 15, wherein R^3 is a hydrogen atom, a halogen atom, C_2-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group.

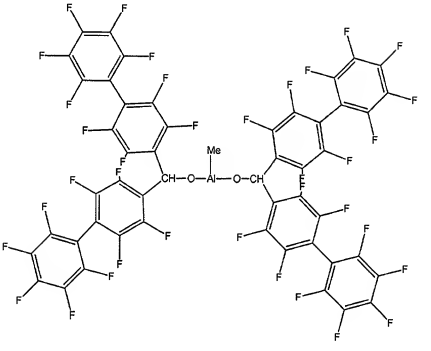
19. A process for preparing a polyolfin in the presence of the catalyst system as claimed in claim 15.

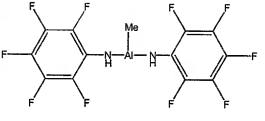
20. A compound of the formula

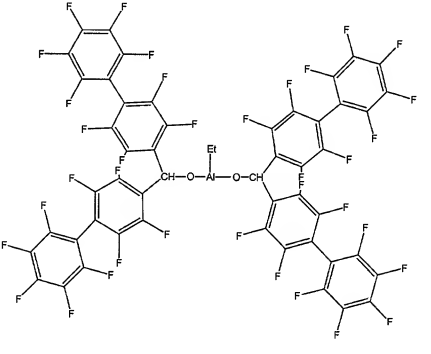


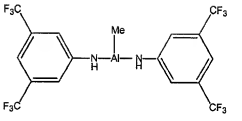


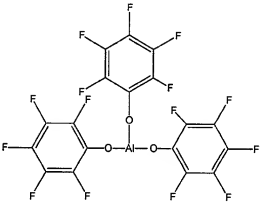


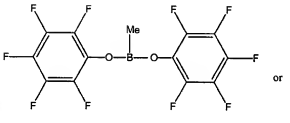




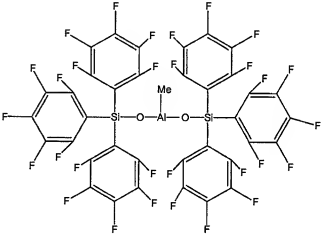








or



21. A catalyst system comprising

A) at least one chemical compound as claimed in claim 20, and

B) at least one transition metal compound which constitutes a metallocene compound, a diamine complex of transition groups III and IV of the Periodic Table of the Elements, a diimine complex of transition group VIII of the Periodic Table of the Elements or a 2,6-bis(imino)pyridine complex of transition group VIII of the Periodic Table of the Elements.

22. The catalyst system as claimed in claim 15, wherein said at least one transition metal compound is a metallocene.

23. The catalyst system as claimed in claim 15, wherein said at least one transition metal compound is a diamine complex of transition groups III and IV of the Periodic Table of the Elements.

24. The catalyst system as claimed in claim 15, wherein said at least one transition metal compound is a diimine complex of transition group VIII of the Periodic Table of the Elements.

25. The catalyst system as claimed in claim 15, wherein said at least one transition metal compound is a 2,6-bis(imino)pyridine complex of transition group VIII of the Periodic Table of the Elements

26. The catalyst system as claimed in claim 16, wherein the support is talc, a silicon dioxide, an aluminum oxide or a polyolefin powder.- -

REMARKS

The applicants respectfully request that the preliminary amendment be entered prior to fee calculation and examination. Support for newly added claims 7-25 can be found in the original claims 1-6 and in the specification at the bottom of page 2 to the top of page 3 and pages 4, 5 and 49. Claims 7-26 are now in the case. There are five independent claims (claims 7, 9, 11, 15 and 20). A fee of $168.00 is enclosed for the two extra independent claims over three.

No additional fee is required for the additional claims. If there are any additional fees due in connection with the filing of this response, the Commissioner is authorized to charge or credit any overpayment to Deposit Account No. 03-2775.

A prompt and favorable action is solicited.

Respectfully submitted,
CONNOLLY BOVE LODGE & HUTZ LLP

By _____
Ashley I. Pezzner
Reg. No. 35,646
Tel. (302) 888-6270

AIP/cam/168215

Chemical compound, its preparation and its use in a catalyst system for preparing polyolefins

The present invention describes a chemical compound which is electrically neutral. In combination with an organometallic compound, it can form a novel catalyst system which is used advantageously for the polymerization of olefins. When using this catalyst system, the use of aluminoxane such as methylaluminoxane (MAO) as cocatalyst can be dispensed with while nevertheless achieving a high catalyst activity.

The role of cationic complexes in Ziegler-Natta polymerization using metallocenes is generally recognized (H.H. Brintzinger, D. Fischer, R. Mülhaupt, R. Rieger, R. Waymouth, Angew. Chem. 1995, 107, 1255-1283).

MAO has hitherto been the most effective cocatalyst but has the disadvantage of having to be used in a large excess, which leads to a high unwanted aluminum content in the polymer. The preparation of cationic alkyl complexes opens the way to MAO-free catalysts having a comparable activity, with the cocatalyst being able to be used in an almost stoichiometric amount.

The synthesis of "cation-like" metallocene polymerization catalysts is described in J. Am. Chem. Soc. 1991, 113, 3623. Here, abstraction of an alkyl group from an alkyl-metallocene compound is carried out by means of trispentafluorophenylborane. EP-A-0 427 697 claims this synthesis principle and a corresponding catalyst system comprising an uncharged metallocene species (e.g. Cp_2ZrMe_2), a Lewis acid (e.g. $B(C_6F_5)_3$) and aluminum alkyls. A process for preparing salts of the formula $LMX^+ XA^-$ according to the above-described principle is disclosed in EP-A-0 520 732.

Disadvantages of the existing, alternative cocatalyst systems are their high sensitivity to catalyst poisons and the problem of leaching in the application of the catalyst systems to supports.

It is an object of the present invention to find a chemical compound having a low coordination tendency which avoids the disadvantages of the prior art and nevertheless makes high polymerization activities possible.

We have found that this object is achieved by a chemical compound, a process for preparing it and its use in a catalyst system for preparing polyolefins. The present invention also

provides a catalyst system comprising at least one chemical compound according to the invention as cocatalyst.

The chemical compound of the present invention has the formula (I),

$$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k \qquad (I)$$

wherein

R^1, R^2 where each a hydrogen atom, a halogen atom, a boron-free C_1-C_{40} group such as C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is a boron-free C_1-C_{40} group such as C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl,

R^3 can be identical to or different from R^1 and R^2 and is a hydrogen atom, a halogen atom, a C_1-C_{40} group such as C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group IV, V or VIa of the Periodic Table of the Elements or an NH group,

M^1 is an element of group IIIa of the Periodic Table of the Elements and

k is a natural number from 1 to 100.

The index k is the result of Lewis acid-base interactions of the chemical compound of the invention to form dimers, trimers or higher oligomers.

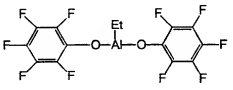
Particular preference is given to compounds in which X is an oxygen atom or an NH group.

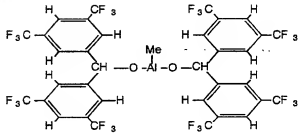
Particular preference is also given to compounds in which M^1 is aluminum or boron.

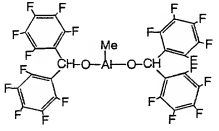
R^1 and R^2 are particularly preferably each a boron-free C_1–C_{40}-hydrocarbon radical which may be halogenated, preferably perhalogenated, by halogen such as fluorine, chlorine, bromine or iodine, in particular a halogenated, especially perhalogenated, C_1–C_{30}-alkyl group such as trifluoromethyl, pentachloroethyl, heptafluoroisopropyl or monofluoroisobutyl or a halogenated C_6–C_{30}-aryl group such as pentafluorophenyl, 2,4,6-trifluorophenyl, heptachloronaphthyl, heptafluoronaphthyl, heptafluorotolyl, 3,5-bis(trifluoromethyl)phenyl, 2,4,6-tris(trifluoromethyl)phenyl, nonafluorobiphenyl or 4-(trifluoromethyl)phenyl. Likewise preferred as R^1 and R^2 are radicals such as phenyl, naphthyl, anisyl, methyl, ethyl, isopropyl, butyl, tolyl, biphenyl or 2,3-dimethylphenyl. Particularly preferred radicals R^1 and R^2 are pentafluorophenyl, phenyl, biphenyl, bisphenylmethylene, 3,5-bis(trifluoromethyl)phenyl, 4-(trifluoromethyl)phenyl, nonafluorobiphenyl, bis(pentafluorophenyl)methylene and 4-methylphenyl.

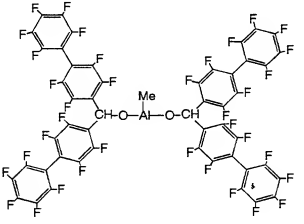
R^3 is particularly preferably a boron-free C_1–C_{40}-hydrocarbon radical which may be halogenated, preferably perhalogenated, by halogen such as fluorine, chlorine, bromine or iodine, in particular a halogenated, especially perhalogenated, C_1–C_{30}-alkyl group such as trifluoromethyl, pentachloroethyl, heptafluoroisopropyl or monofluoroisobutyl or a halogenated C_6–C_{30}-aryl group such as pentafluorophenyl, 2,4,6-trifluorophenyl, heptachloronaphthyl, heptafluoronaphthyl, heptafluorotolyl, 3,5-bis(trifluoromethyl)phenyl, 2,4,6-tris(trifluoromethyl)phenyl, nonafluorobiphenyl or 4-(trifluoromethyl)phenyl. Likewise-preferred radicals R^3 are such as phenyl, naphthyl, anisyl, methyl, ethyl, isopropyl, butyl, tolyl, biphenyl or 2,3-dimethylphenyl. Particularly preferred radicals R^3 are methyl, ethyl, isopropyl, butyl, pentafluorophenyl, phenyl, biphenyl, bisphenylmethylene, 3,5-bis(trifluoromethyl)phenyl, 4-(trifluoromethyl)phenyl, nonafluorobiphenyl, bis(pentafluorophenyl)methylene and 4-methylphenyl.

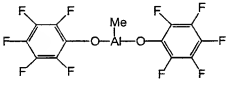
Nonrestrictive examples to illustrate the formula I (which may also be unfluorinated) are:

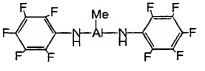


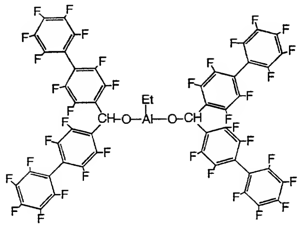


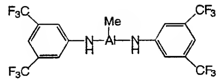


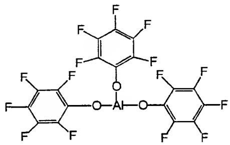


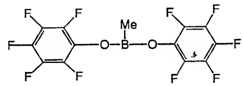


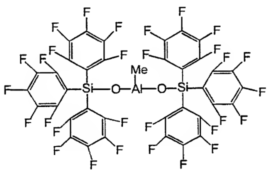












The novel compounds of the formula (I) are prepared from organoaluminum or organoboron compounds of the formula (II),

$(R^5)_3Y$ (II)

where

R^5 can be a hydrogen atom or a boron-free C_1-C_{40} group such as C_1-C_{20}-alkyl, C_6-C_{20}-aryl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or a halogen atom,

Y is boron or aluminum.

Nonrestrictive examples of preferred compounds of the formula (II) are:

trimethylaluminum, triethylaluminum, triisobutylaluminum, trihexylaluminum, trioctylaluminum, tri-n-butylaluminum, tri-n-propylaluminum, triisoprenaluminum, aluminum trichloride, aluminum tribromide, trimethylborane, triethylborane, triisobutylborane, boron trichloride, boron tribromide, boron triodide, pentafluorophenyldimethylborane and pentafluorophenyldimethylaluminum

The novel compound of the formula (I) is prepared by reacting the compound of the formula (II) with compounds of the formula (III).

$$(R^6)\ X(R^1R^2) \quad (III)$$

where

R^1 and R^2 are as defined under formula (I),

X is an oxygen atom, a sulfur atom or an NH group, preferably oxygen or an NH group,

R^6 is hydrogen, a C_1-C_{40} group or a p-toluenesulfonic acid radical.

Nonrestrictive examples of the compound of the formula (III) are:

pentafluorophenol, phenol, bis(pentafluorophenyl) carbinol, bis(phenyl) carbinol, pentafluoroaniline, tris(pentafluorophenyl)silanol, bis(nonafluorobiphenyl) carbinol, tris(nonafluorobiphenyl)silanol, nonafluorobiphenyl-1-ol, nonafluorodiphenyl-1-amine, tris(phenyl)silanol, 3,5-bis(trifluoromethyl)aniline, 3,5-bis(trifluoromethyl)phenol, bis(2,3,4-trifluorophenyl) carbinol, bis(3,5-trifluoromethylphenyl) carbinol, 2,3,4-trifluorophenol, 2,3,4-trifluoroaniline, tris(2,3,4-trifluorophenyl)silanol, 2,4,6-trifluoroaniline, 2,4,6-trifluorophenol, tris(2,4,6-trifluorophenyl)silanol, 3,5-difluorophenol, 3,5 difluoroaniline, bis(3,5-difluorophenyl) carbinol, bis(2,4,6-difluorophenyl) carbinol

The preparation of the novel compound of the formula (I) is described in more detail below:

In step A), one or more compounds of the formula (II) are placed in a reaction vessel. The compounds can either be present as a solution or suspension in a solvent, or else can be present as such. Solvents which can be used are aliphatic or aromatic hydrocarbons, such as n-pentane, isopentane, n-hexane, n-heptane,

cyclohexane, isododecane, n-octane, n-nonane, n-decane, petroleum ether, toluene, benzene, o-xylene, m-xylene, p-xylene, 1,2,3-trimethylbenzene, 1,2,4-trimethylbenzene, 1,2,5-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, propylbenzene, etc, and also mixtures of these. One or more compounds of the formula (II) are placed in the reaction vessel at from -100°C to 300°C.

Preference is given to temperatures in the range from -80°C to 200°C. Particular preference is given to temperatures in the range from -80°C to 40°C. The compound of the formula (II) should be present as or in a liquid phase.

This is followed by the addition of one or more compounds of the formula (III). These can likewise be present as a solution or suspension in a solvent or else can be present as such. Solvents which can be used are those described above; preference is given to using the same solvent. The addition is carried out over a period of from 1 minute to 96 hours. Preference is given to an addition time of from 10 minutes to 8 hours. The temperature of the initial charge during the addition is in the range from -100°C to 200°C. Preference is given to temperatures in the range from -80°C und 100°C. Particular preference is given to temperatures in the range from -80°C to 40°C. The temperature is selected so that at least one reactant is present as or in a liquid phase. Furthermore, the reaction is carried out at atmospheric pressure. Depending on the physical properties of the compounds of the formula (II), cooling is carried out by means of a low-temperature cooler which may be operated using refrigerants.

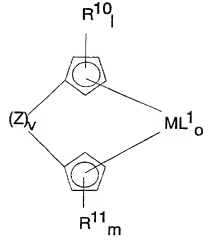
The stoichiometric ratio of compounds of the formula (II) to compounds of the formula (III) is from 1 : 1000 to 1 : 100. Preference is given to a stoichiometric ratio of compounds of the formula (II) to compounds of the formula (III) of from 1 : 100 to 1 : 1, particular preference is given to 1 : 2.

The reaction temperature is in the range from -100°C to 200°C. Preference is given to a reaction temperature in the range from -80°C to 150°C. Particular preference is given to a reaction temperature in the range from -80°C to 40°C. At least one of the reactants is preferably present as or in a liquid phase. The reaction time is, depending on the reaction temperature selected and the chosen compounds of the formula (III), in the range from 1 minute to 96 hours. Preference is given to a reaction time of from 10 minutes to 8 hours.

The resulting compounds of the formula (I) can, in step B), be isolated by means of known technologies, e.g. distillation, recrystallization, extraction or sublimation.

The novel chemical compounds of the formula (I) can be used together with an organometallic transition metal compound to form a catalyst system which is likewise subject matter of the present invention. Organometallic transition metal compounds used can be, for example, metallocene compounds. These may be, for example, bridged or unbridged biscyclopentadienyl complexes as are described in EP-A-0 129 368, EP-A-0 561 479, EP-A-0 545 304 and EP-A-0 576 970, monocyclopentadienyl complexes such as bridged amidocyclopentadienyl complexes described in, for example, EP-A-0 416 815, multinuclear cyclopentadienyl complexes as described, for example, in EP-A-0 632 063, π-ligand-substituted tetrahydropentalenes as described, for example, in EP-A-0 659 758 or π-ligand-substituted tetrahydroindenes as described, for example, in EP-A-0 661 300. It is also possible to use organometallic compounds in which the complexing ligand contains no cyclopentadienyl ligand. Examples are diamine complexes of transition groups III and IV of the Periodic Table of the Elements, as are described, for example, in D.H. McConville, et al, Macromolecules, 1996, 29, 5241, and D.H. McConville, et al, J. Am. Chem. Soc., 1996, 118, 10008. It is also possible to use diimine complexes of transition group VIII of the Periodic Table of the Elements (e.g. Ni^{2+} or Pd^{2+} complexes), as are described in Brookhart et al, J. Am. Chem. Soc. 1995, 117, 6414, and Brookhart et al, J. Am. Chem. Soc., 1996, 118, 267. 2,6-Bis(imino)pyridyl complexes of transition group VIII of the Periodic Table of the Elements (e.g. Co^{2+} or Fe^{2+} complexes), as are described in Brookhart et al, J. Am. Chem. Soc. 1998, 120, 4049, and Gibson et al, Chem. Commun. 1998, 849, can also be used. Furthermore, it is possible to use metallocene compounds whose complexing ligand contains heterocycles. Examples of such compounds are described in WO 98/22486.

Preferred metallocene compounds are unbridged or bridged compounds of the formula (IV),



(IV)

where

M is a metal of transition group III, IV, V or VI of the Periodic Table of the Elements, in particular Ti, Zr or Hf,

R^{10} are identical or different and are each a hydrogen atom or $Si(R^{12})_3$, where R^{12} are identical or different and are each a hydrogen atom or a C_1-C_{40} group, preferably C_1-C_{20}-alkyl, C_1-C_{10}-fluoroalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{10}-fluoroaryl, C_6-C_{10}-aryloxy, C_2-C_{10}-alkenyl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or C_8-C_{40}-arylalkenyl, or R^{10} is a C_1-C_{30} group, preferably C_1-C_{25}-alkyl such as methyl, ethyl, tert-butyl, cyclohexyl or octyl, C_2-C_{25}-alkenyl, C_3-C_{15}-alkylalkenyl, C_6-C_{24}-aryl, C_5-C_{24}-heteroaryl, C_7-C_{30}-arylalkyl, C_7-C_{30}-alkylaryl, fluorinated C_1-C_{25}-alkyl, fluorinated C_6-C_{24}-aryl, fluorinated C_7-C_{30}-arylalkyl, fluorinated C_7-C_{30}-alkylaryl or C_1-C_{12}-alkoxy, or two or more radicals R^{10} may be joined to one another in such a way that the radicals R^{10} and the atoms of the cyclopentadienyl ring which connect them form a C_4-C_{24} ring system which may in turn be substituted,

R^{11} are identical or different and are each a hydrogen atom or $Si(R^{12})_3$, where R^{12} are identical or different and are each a hydrogen atom or a C_1-C_{40} group, preferably C_1-C_{20}-alkyl, C_1-C_{10}-fluoroalkyl, C_1-C_{10}-alkoxy, C_6-C_{14}-aryl, C_6-C_{10}-fluoroaryl, C_6-C_{10}-aryloxy, C_2-C_{10}-alkenyl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or C_8-C_{40}-arylalkenyl, or R^{11} is a C_1-C_{30} group, preferably

C_1-C_{25}-alkyl such as methyl, ethyl, tert-butyl, cyclohexyl or octyl, C_2-C_{25}-alkenyl, C_3-C_{15}-alkylalkenyl, C_6-C_{24}-aryl, C_5-C_{24}-heteroaryl, C_5-C_{24}-heteroalkylaryl, C_7-C_{30}-arylalkyl, C_7-C_{30}-alkylaryl, fluorinated C_1-C_{25}-alkyl, fluorinated C_6-C_{24}-aryl, fluorinated C_7-C_{30}-arylalkyl, fluorinated C_7-C_{30}-alkylaryl or C_1-C_{12}-alkoxy, or two or more radicals R^{11} may be joined to one another in such a way that the radicals R^{11} and the atoms of the cyclopentadienyl ring which connect them form a C_4-C_{24} ring system which may in turn be substituted,

l is 5 when v = 0, and l is 4 when v = 1,

m is 5 when v = 0, and m is 4 when v = 1,

L^1 may be identical or different and are each a hydrogen atom, a C_1-C_{10}-hydrocarbon group such as C_1-C_{10}-alkyl or C_6-C_{10}-aryl, a halogen atom, or OR^{16}, SR^{16}, $OSi(R^{16})_3$, $Si(R^{16})_3$, $P(R^{16})_2$ or $N(R^{16})_2$, where R^{16} is a halogen atom, a C_1-C_{10}-alkyl group, a halogenated C_1-C_{10}-alkyl group, a C_6-C_{20}-aryl group or a halogenated C_6-C_{20}-aryl group, or each L^1 is a toluenesulfonyl, trifluoroacetyl, trifluoroacetoxyl, trifluoromethanesulfonyl, nonafluorobutanesulfonyl or 2,2,2-trifluoroethanesulfonyl group,

o is an integer from 1 to 4, preferably 2,

Z is a bridging structural element between the two cyclopentadienyl rings and v is 0 or 1.

Examples of Z are $M^2R^{13}R^{14}$ groups, where M^2 is carbon, silicon, germanium or tin and R^{13} and R^{14} are identical or different and are each a C_1-C_{20} group such as C_1-C_{10}-alkyl, C_6-C_{14}-aryl or trimethylsilyl. Z is preferably CH_2, CH_2CH_2, $CH(CH_3)CH_2$, $CH(C_4H_9)C(CH_3)_2$, $C(CH_3)_2$, $(CH_3)_2Si$, $(CH_3)_2Ge$, $(CH_3)_2Sn$, $(C_6H_5)_2Si$, $(C_6H_5)(CH_3)Si$, $(C_6H_5)_2Ge$, $(C_6H_5)_2Sn$, $(CH_2)_4Si$, $CH_2Si(CH_3)_2$, o-C_6H_4 or 2,2'-$(C_6H_4)_2$. It is also possible for Z together with one or more radicals R^{10} and/or R^{11} to form a monocyclic or polycyclic ring system.

Preference is given to chiral bridged metallocene compounds of the formula (IV), in particular those in which v is 1 and one or both cyclopentadienyl rings are substituted so that they form an indenyl ring. The indenyl ring is preferably substituted, in particular in the 2 position, 4 position, 2,4,5 positions, 2,4,6

positions, 2,4,7 positions or 2,4,5,6 positions, by C_1-C_{20} groups such as C_1-C_{10}-alkyl or C_6-C_{20}-aryl, where two or more substituents of the indenyl ring may also together form a ring system.

Chiral bridged metallocene compounds of the formula (IV) can be used as pure racemic or pure meso compounds. However, it is also possible to use mixtures of a racemic compound and a meso compound.

Examples of metallocene compounds are:

dimethylsilanediylbis(indenyl)zirconium dichloride

dimethylsilanediylbis(4-naphthyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-benzo-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(1-naphthyl)-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(2-naphthyl)-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-t-butyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-isopropyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-ethyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-α-acenaphthindenyl)zirconium dichloride

dimethylsilanediylbis(2,4-dimethylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-ethylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-phenylindenyl)zirconium dichloride

Dimethylsilandiybis(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4,6 diisopropylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4,5 diisopropylindenyl)zirconium dichloride

dimethylsilanediylbis(2,4,6-trimethylindenyl)zirconium dichloride

dimethylsilanediylbis(2,5,6-trimethylindenyl)zirconium dichloride

dimethylsilanediylbis(2,4,7-trimethylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-5-isobutylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-5-t-butylindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4-phenylindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4,6-diisopropylindenyl) zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4-isopropylindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4,5-benzoindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4,5-(methylbenzo)indenyl) zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4,5-(tetramethylbenzo)indenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-4-α-acenaphthindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methylindenyl)zirconium dichloride

methyl(phenyl)silanediylbis(2-methyl-5-isobutylindenyl)zirconium dichloride

1,2-ethanediylbis(2-methyl-4-phenylindenyl)zirconium dichloride

1,4-butanediylbis(2-methyl-4-phenylindenyl)zirconium dichloride

1,2-ethanediylbis(2-methyl-4,6-diisopropylindenyl)zirconium dichloride

1,4-butanediylbis(2-methyl-4-isopropylindenyl)zirconium dichloride

1,4-butanediylbis(2-methyl-4,5-benzoindenyl)zirconium dichloride

1,2-ethanediylbis(2-methyl-4,5-benzoindenyl)zirconium dichloride

1,2-ethanediylbis(2,4,7-trimethylindenyl)zirconium dichloride

1,2-ethanediylbis(2-methyl-indenyl)zirconium dichloride

1,4-butanediylbis(2-methylindenyl)zirconium dichloride

[4-(η^5-cyclopentadienyl)-4,6,6-trimethyl-(η^5-4,5-tetrahydropentalene)]dichlorozirconium

[4-(η^5-3'-trimethylsilylcyclopentadienyl)-4,6,6-trimethyl-(η^5-4,5-tetrahydropentalene)]dichlorozirconium

[4-(η^5-3'-isopropylcyclopentadienyl)-4,6,6-trimethyl-(η^5-4,5-tetrahydropentalene)]dichlorozirconium

[4-(η^5-cyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorotitanium

[4-(η^5-cyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorozirconium

[4-(η^5-cyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorohafnium

[4-(η^5-3'-tert-butylcyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorotitanium

4-(η^5-3'-isopropylcyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorotitanium

4-(η^5-3'-methylcyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorotitanium

4-(η^5-3'-trimethylsilylcyclopentadienyl)-2-trimethylsilyl-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorotitanium

4-(η^5-3'-tert-butylcyclopentadienyl)-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)]dichlorozirconium

(tertbutylamido)(tetramethyl-η^5-cyclopentadienyl)dimethylsilyldichlorotitanium

(tertbutylamido)(tetramethyl-η^5-cyclopentadienyl)-1,2-ethanediyl-dichlorotitanium-dichlorotitanium

(methylamido)(tetramethyl-η^5-cyclopentadienyl)dimethylsilyldichlorotitanium

(methylamido)(tetramethyl-η^5-cyclopentadienyl)-1,2-ethanediyldichlorotitanium

(tert-butylamido)(2,4-dimethyl-2,4-pentadien-1-yl)dimethylsilyldi chlorotitanium

bis(cyclopentadienyl)zirconium dichloride

bis(n-butylcyclopentadienyl)zirconium dichloride

bis(1,3-dimethylcyclopentadienyl)zirconium dichloride

tetrachloro[1-[bis(η^5-1H-inden-1-ylidene)methylsilyl]-3-η^5-cyclopenta-2,4-dien-1-ylidene)-3-η^5-9H-fluoren-9-ylidene)butane]dizirconium

tetrachloro[2-[bis(η^5-2-methyl-1H-inden-1-ylidene)methoxysilyl]-5-(η^5-2,3,4,5-tetramethylcyclopenta-2,4-dien-1-ylidene)-5-(η^5-9H-fluoren-9-ylidene)hexane]dizirconium

tetrachloro[1-[bis(η^5-1H-inden-1-ylidene)methylsilyl]-6-(η^5-cyclopenta-2,4-dien-1-ylidene)-6-(η^5-9H-fluoren-9-ylidene)-3-oxaheptane]dizirconium

dimethylsilanediylbis(2-methyl-4-(tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4-methylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4-ethylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4-trifluoromethylphenylindenyl) zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4-methoxyphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4-methylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4-ethylphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4-trifluoromethylphenylindenyl) zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4-methoxyphenylindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4-tert-butylphenylindenyl) zirconium dimethyl

dimethylsilanediylbis(2-methyl-4-(4-methylphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-methyl-4-(4-ethylphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-methyl-4-(4-trifluoromethylphenylindenyl) zirconium dimethyl

dimethylsilanediylbis(2-methyl-4-(4-methoxyphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-ethyl-4-(4-tert-butylphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-ethyl-4-(4-methylphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-ethyl-4-(4-ethylphenylindenyl)zirconium diethyl

dimethylsilanediylbis(2-ethyl-4-(4-trifluoromethylphenylindenyl) zirconium dimethyl

dimethylsilanediylbis(2-ethyl-4-(4-methoxyphenylindenyl)zirconium dimethyl

dimethylsilanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl) hafnuim dichloride

dimethylsilanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl)titanium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-methylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-n-propylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-n-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-hexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-sec-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-phenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-methylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-ethylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-n-propylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-n-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-hexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-pentylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-cyclohexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-sec-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-phenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-methylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-ethylphenyl)-indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-isopropylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-n-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-hexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-cyclohexylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-sec-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-propyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-phenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-methylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-ethylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-n-propylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-isopropylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-n-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-hexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-cyclohexylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-sec-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-n-butyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-phenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-methylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-ethylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-n-propylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-isopropylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-n-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-hexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-cyclohexylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-sec-butylphenyl)indenyl) zirconium dichloride

dimethylsilanediylbis(2-hexyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl) zirconium bis(dimethylamide)

dimethylsilanediylbis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dibenzyl

dimethylsilanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl) zirconium dimethyl

dimethylgermanediylbis(2-ethyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

dimethylgermanediylbis(2-ethyl-4-(4'-tert-butylphenyl)indenyl) hafnium dichloride

dimethylgermanediylbis(2-propyl-4-(4'-tert-butylphenyl)indenyl) titanium dichloride

dimethylgermanediylbis(2-methyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

ethylidenebis(2-ethyl-4-phenyl)indenyl)zirconium dichloride

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

ethylidenebis(2-n-propyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

ethylidenebis(2-n-butyl-4-(4'-tert-butylphenyl)indenyl)titanium dichloride

ethylidenebis(2-hexyl-4-(4'-tert-butylphenyl)indenyl)zirconium dibenzyl

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)hafnium dibenzyl

ethylidenebis(2-methyl-4-(4'-tert-butylphenyl)indenyl)titanium dibenzyl

ethylidenebis(2-methyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)hafnium dimethyl

ethylidenebis(2-n-propyl-4-phenyl)indenyl)titanium dimethyl

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium bis(dimethylamide)

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)hafnium bis(dimethylamide)

ethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)titanium bis(dimethylamide)

methylethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

methylethylidenebis(2-ethyl-4-(4'-tert-butylphenyl)indenyl)hafnium dichloride

phenylphosphinediyl(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

phenylphosphinediyl(2-methyl-4-(4'-tert-butylphenyl)indenyl) zirconium dichloride

phenylphosphinediyl(2-ethyl-4-(4'-tert-butylphenyl)indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-methyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-ethyl phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-ethylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-n-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-iso-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-iso-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-iso-propylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-isopropylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-n-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-s-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-n-pentylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-n-hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-cyclo hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-cyclo hexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-cyclohexylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-trimethylsilylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-adamantylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-(4'-tris (trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-ethyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5,6-di-hydro-4-azapentalene)(2-ethyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-ethyl-4-(4'-tert-butylphenyl-tetrahydroindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-n-butyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

Ethyliden(2-methyl-6-azapentalene)(2-methyl-4-(4'-tert-butyl-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-trimethylsilyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-tolyl-5-azapentalene)(2-n-propyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

Dimethylgermyldiyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

Methylethyliden(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-di-iso-propyl-6-azapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2,6-dimethyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(6'-tert-butylnaphthylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4-(6'-tert-butylanthracenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-phosphapentalen)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

diphenylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

methylphenylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

methylidene(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylmethylidene(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

diphenylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

diphenylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-(4'-tert-butylphenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methylindenyl) zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(indenyl) zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(indenyl) zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4-phenyl-indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4-phenyl-indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4-phenyl-indenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4-phenyl indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4-phenyl indenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl -4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl -4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4-phenylindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-4-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-N-phenyl-6-azapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-thiapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-thiapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-thiapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-thiapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-thiapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-4-oxapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-5-oxapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2-methyl-6-oxapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-4-oxapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediyl(2,5-dimethyl-6-oxapentalene)(2-methyl-4,5-benzoindenyl)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-5-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-6-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-N-phenyl-4-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-N-phenyl-5-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-N-phenyl-6-azapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-4-azapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-6-azapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-N-phenyl-4-azapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-N-phenyl-6-azapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-thiapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-5-thiapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-6-thiapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-4-thiapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-6-thiapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-4-oxapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-5-oxapentalene)zirconium dichloride

dimethylsilanediylbis(2-methyl-6-oxapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-4-oxapentalene)zirconium dichloride

dimethylsilanediylbis(2,5-dimethyl-6-oxapentalene)zirconium dichloride

Further examples of metallocenes which can be used for the purposes of the present invention are metallocenes as listed above in which the zirconium fragment "zirconium dichloride" is replaced by

zirconium monochloride mono(2,4-di-tert-butylphenoxide)

zirconium monochloride mono(2,6-di-tert-butylphenoxide)

zirconium monochloride mono(3,5-di-tert-butylphenoxide)

zirconium monochloride mono(2,6-di-sec-butylphenoxide)

zirconium monochloride mono(2,4-di-methylphenoxide)

zirconium monochloride mono(2,3-di-methylphenoxide)

zirconium monochloride mono(2,5-di-methylphenoxide)

zirconium monochloride mono(2,6-di-methylphenoxide)

zirconium monochloride mono(3,4-di-methylphenoxide)

zirconium monochloride mono(3,5-di-methylphenoxide)

zirkonium monochloride monophenoxide

zirconium monochloride mono(2-methylphenoxide)

zirconium monochloride mono(3-methylphenoxide)

zirconium monochloride mono(4-methylphenoxide)

zirconium monochloride mono(2-ethylphenoxide)

zirconium monochloride mono(3-ethylphenoxide)

zirconium monochloride mono(4-ethylphenoxide)

zirconium monochloride mono(2-sec-butylphenoxide)

zirconium monochloride mono(2-tert-butylphenoxide)

zirconium monochloride mono(3-tert-butylphenoxide)

zirconium monochloride mono(4-sec-butylphenoxide)

zirconium monochloride mono(4-tert-butylphenoxide)

zirconium monochloride mono(2-isopropyl-5-methylphenoxide)

zirconium monochloride mono(4-isopropyl-3-methylphenoxide)

zirconium monochloride mono(5-isopropyl-2-methylphenoxide)

zirconium monochloride mono(5-isopropyl-3-methylphenoxide)

zirconium monochloride mono(2,4-bis-(2-methyl-2-butyl)-phenoxide)

zirconium monochloride mono(2,6-di-tert-butyl-4-methyl-phenoxide)

zirconium monochloride mono(4-nonylphenoxide)

zirconium monochloride mono(1-naphthoxide)

zirconium monochloride mono(2-naphthoxide)

zirconium monochloride mono(2-phenylphenoxide)

zirconium monochloride mono(tert-butoxid)

zirconium monochloride mono(N-methylanilide)

zirconium monochloride mono(2-tert-butylanilide)

zirconium monochloride mono(tert-butylamide)

zirconium monochloride mono(diisopropylamide)

zirconium monochloride monomethyl

zirconium monochloride monobenzyl

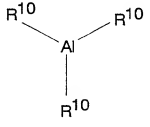
zirconium monochloride mononeopentyl.

Preference is also given to the corresponding dimethylzirconium compounds, the corresponding η^4-butadienezirconium compounds and the corresponding compounds having a 1,2-(1-methylethanediyl), 1,2-(1,1-dimethylethanediyl) or 1,2(1,2-dimethylethanediyl) bridge.

The catalyst system of the present invention can be prepared by reacting one or more compounds of the formula (I) with an organometallic transition metal compound of the formula (IV) in any desired stoichiometric ratio.

The catalyst system of the present invention can further comprise an aluminum compound of the formula (V)

(V)



The radicals R^{20} in the formula (V) may be identical or different and are each a halogen atom, a hydrogen atom, a C_1-C_{40} group, preferably C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl or C_7-C_{40}-haloalkylaryl.

Preferred radicals R^{20} are C_1-C_6-alkyl groups, particularly preferably C_1-C_4-alkyl groups.

The compound of the formula (V) can be added in any desired stoichiometric ratio.

In the preparation of the catalyst system of the present invention, the compounds of the formula (I) and of the formula (IV) are used in a B : M molar ratio of from 0.01 to 10 000. Particular preference is given to a molar ratio of from 0.1 to 1000, very particularly preferably from 1 to 100. A compound of the formula (V) can additionally be added thereto in an Al : M molar ratio of from 0.01 to 10 000. Preference is given to a molar ratio of from 0.1 to 1000, very particularly preferably from 1 to 100.

The compounds can be brought into contact with one another in any conceivable combination. A possible procedure is to dissolve or suspend an organometallic transition metal compound of the formula (IV) in an aliphatic or aromatic solvent and then to add a compound of the formula (V) in dissolved or suspended form. The reaction time is from 1 minute to 24 hours, preferably from 5 minutes to 120 minutes. The reaction temperature is in the range from -10°C to +200°C, preferably from 0°C to 50°C. An organoboron compound of the formula (I) is subsequently added either as such or in dissolved or suspended form. The reaction time is from 1 minute to 24 hours, preferably from 5 minutes to 120 minutes. The reaction temperature is in a range from -10°C to +200°C, preferably from 0°C to 50°C. The individual compounds can also be introduced into the polymerization vessel successively in any desired order.

The catalyst systems of the present invention can also be used in supported form.

The support component of the catalyst system of the present invention can be any organic or inorganic, inert solid, in particular a porous support such as talc, inorganic oxides and finely divided polymer powders (e.g. polyolefins).

Suitable inorganic oxides are oxides of elements of groups 2, 3, 4, 5, 13, 14, 15 and 16 of the Periodic Table of the Elements. Examples of oxides preferred as supports include silicon dioxide, aluminum oxide and also mixed oxides of the two elements and corresponding oxide mixtures. Other inorganic oxides which can be used alone or in combination with the abovementioned preferred oxidic supports are, for example, MgO, ZrO_2 , TiO_2 or B_2O_3, to name only a few.

The support materials used have a specific surface area in the range from 10 to 1000 m^2/g, a pore volume in the range from 0.1 to 5 ml/g and a mean particle size of from 1 to 500 µm. Preference is given to supports having a specific surface area in the range

from 50 to 500 µm , a pore volume in the range from 0.5 to 3.5 ml/g and a mean particle size in the range from 5 to 350 µm. Particular preference is given to supports having a specific surface area in the range from 200 to 400 m^2/g, a pore volume in the range from 0.8 to 3.0 ml/g and a mean particle size of from 10 to 200 µm.

If the support material used naturally has a low moisture content or residual solvent content, dehydration or drying before use can be omitted. If this is not the case, for example when using silica gel as support material, dehydration or drying is advisable. Thermal dehydration or drying of the support material can be carried out under reduced pressure with simultaneous inert gas blanketing (e.g. nitrogen). The drying temperature is in the range from 100 to 1000°C, preferably from 200 to 800°C. The parameter pressure is not critical in this case. The duration of the drying process can be from 1 to 24 hours. Shorter or longer drying times are possible provided that equilibrium with the hydroxyl groups on the support surface can be established under the chosen conditions, which normally takes from 4 to 8 hours.

Dehydration or drying of the support material can also be carried out by chemical means, by reacting the adsorbed water and the hydroxyl groups on the surface with suitable passivating agents. The reaction with the passivating reagent can convert all or some of the hydroxyl groups into a form which leads to no adverse interaction with the catalytically active centres. Suitable passivating agents are, for example, silicon halides and silanes, e.g. silicon tetrachloride, chlorotrimethylsilane, dimethylaminotrichlorosilane, or organometallic compounds of aluminum, boron and magnesium, for example trimethylaluminum, triethylaluminum, triisobutylaluminum, triethylborane, dibutylmagnesium. Chemical dehydration or passivation of the support material is carried out, for example, by reacting a suspension of the support material in a suitable solvent with the passivating reagent in pure form or as a solution in a suitable solvent in the absence of air and moisture. Suitable solvents are, for example, aliphatic or aromatic hydrocarbons such as pentane, hexane, heptane, toluene or xylene. Passivation is carried out at from 25°C to 120°C, preferably from 50°C to 70°C. Higher and lower temperatures are possible. The reaction time is in the range from 30 minutes to 20 hours, preferably from 1 to 5 hours. After chemical dehydration is complete, the support material is isolated by filtration under inert conditions, washed one or more times with suitable inert solvents as have been

described above and subsequently dried in a stream of inert gas or under reduced pressure.

Organic support materials such as finely divided polyolefin powders (e.g. polyethylene, polypropylene or polystyrene) can also be used and should likewise be freed of adhering moisture, solvent residues or other impurities by appropriate purification and drying operations before use.

The catalyst systems of the present invention can be brought into contact with the support in any conceivable combination. A conceivable variant comprises placing an organometallic compound of the formula IV together with an aliphatic or aromatic solvent such as toluene, heptane, tetrahydrofuran or diethyl ether in a reaction vessel. One or more compounds of the formula (V) are subsequently added, either as such or in dissolved form. The reaction time is in the range from 1 minute to 24 hours, preferably from 5 minutes to 120 minutes. The reaction temperature is in the range from -10°C to +200°C, preferably from 0°C to 50°C. This is followed by addition of one or more compounds of the formula (I), either as such or in dissolved form. Here too, the reaction time is from 1 minute to 24 hours, preferably from 5 minutes to 120 minutes. The reaction temperature is in the range from -10°C to +200°C, preferably from 0°C to 50°C. All starting materials can be used in any desired stoichiometric ratio. Preference is given to using the compounds of the formula (V) and of the formula (IV) in an Al:M^1 molar ratio of from 0.1 bis 10 000, very particularly preferably from 1 to 100. The compounds of the formula (I) and of the formula (IV) are preferably used in a B:M^1 molar ratio of from 0.1 to 1000, very particularly preferably from 1 to 100.

The composition obtained in this way is then mixed with the dehydrated or passivated support material, the solvent is removed and the resulting supported metallocene catalyst system is dried to ensure that all or most of the solvent is removed from the pores of the support material. The supported catalyst is obtained as a free-flowing powder.

The present invention also provides a process for preparing a polyolefin by polymerization of one or more olefins in the presence of the catalyst system of the present invention comprising at least one transition metal component of the formula (IV). For the purposes of the present invention, the term polymerization encompasses both homopolymerization and copolymerization.

Preference is given to polymerizing olefins of the formula R_m-CH=CH-R_n, where R_m and R_n are identical or different and are each a hydrogen atom or a carbon-containing radical having from 1 to 20 carbon atoms, in particular from 1 to 10 carbon atoms, and R_m and R_n together with the atoms connecting them may form one or more rings.

Examples of such olefins are 1-olefins having 2 - 40 carbon atoms, preferably from 2 to 10 carbon atoms, e.g. ethene, propene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene or 1-octene, styrene, dienes such as 1,3-butadiene, 1,4-hexadiene, vinylnorbornene, norbornadiene, ethylnorbornadiene, and cyclic olefins such as norbornene, tetracyclododecene or methylnorbornene. In the process of the present invention, preference is given to homopolymerizing propene or ethene or copolymerizing propene with ethene and/or with one or more 1-olefins having from 4 to 20 carbon atoms, e.g. hexene, and/or one or more dienes having from 4 to 20 carbon atoms, e.g. 1,4-butadiene, norbornadiene, ethylidenenorbornene or ethylnorbornadiene. Examples of such copolymers are ethene-propene copolymers and ethene-propene/1,4-hexadiene terpolymers.

The polymerization is carried out at from -60°C to 300°C, preferably from 50°C to 200°C, very particularly preferably 50°C - 80°C. The pressure is from 0.5 to 2000 bar, preferably from 5 to 64 bar.

The polymerization can be carried out in solution, in bulk, in suspension or in the gas phase, continuously or batchwise, in one or more stages.

The catalyst system prepared according to the present invention can be used for the polymerization of olefins having from 2 to 20 carbon atoms as sole catalyst component or preferably in combination with at least one alkyl compound of an element of main groups I to III of the Periodic Table, e.g. an aluminum, magnesium or lithium alkyl or an aluminoxane. The alkyl compound is added to the monomer or suspension medium and serves to free the monomer of substances which can impair the catalyst activity. The amount of alkyl compound added depends on the quality of the monomers used.

As molar mass regulator and/or to increase the activity, hydrogen is added if necessary.

In addition, an antistatic can be metered into the polymerization system during the polymerization either together with or separately from the catalyst system used.

The polymers prepared using the catalyst system of the present invention display a uniform particle morphology and contain no fines. In the polymerization using the catalyst system of the present invention, no deposits or caked material occur.

The catalyst system of the present invention gives polymers such as polypropylene with extraordinarily high stereospecificity and regiospecificity.

The isotactic polypropylene prepared using the catalyst system of the present invention has a proportion of 2-1-inserted propene units RI of < 0.5% at a triad tacticity TT of > 98.0% and a melting point of > 156°C, with the polydispersity M_w/M_n of the polypropylene prepared according to the present invention being from 2.5 to 3.5.

The copolymers which can be prepared using the catalyst system of the present invention have a significantly higher molar mass than is achievable according to the prior art. At the same time, such copolymers can be prepared with high productivity at industrially relevant process parameters without formation of deposits when using the catalyst system of the present invention.

The polymers prepared by the process of the present invention are suitable, in particular, for producing strong, hard and stiff shaped bodies such as fibers, filaments, injection-molded parts, films, sheets or large hollow bodies (e.g. pipes).

The following examples illustrate the invention.

General procedures: Preparation and handling of the compounds were carried out in the absence of air and moisture under argon (Schlenk technique). All solvents required were dried before use by boiling for a number of hours over suitable desiccants and subsequent distillation under argon. To characterize the compounds, samples were taken from the individual reaction mixtures and dried in an oilpump vacuum.

Example 1: Synthesis of bis(pentafluorophenyloxy)methylalane (1)

5.2 ml of trimethylaluminum (2M in Exxol, 10.8 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 4.0 g (21.6 mmol) of pentafluorophenol in 40 ml of

toluene are added dropwise to this solution over a period of 30 minutes. The mixture is stirred for 15 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another hour at room temperature. This results in a colorless solution (0.14 M based on Al) of bis(pentafluorophenyloxy)methylalane.

19F-NMR (C_6D_6): δ = -160.5 ppm (m, 4F,o-C_6F_5); -161.8 ppm (m, 2F, p-C_6F_5); -166.3 ppm (m, 4F, m-C_6F_5).

1H-NMR (C_6D_6): δ = -0.4 ppm (s, 3H, CH_3).

Example 2: Synthesis of bis(pentafluorophenyloxy)ethylalane (2)

5.0 ml of triethylaluminum (2.1 M in Vasol, 10.5 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 4.0 g (21.0 mmol) of pentafluorophenol in 40 ml of toluene are added dropwise to this solution over a period of 30 minutes. The mixture is stirred for 15 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another hour at room temperature. This results in a colorless solution (0.13 M based on Al) of bis(pentafluorophenyloxy)ethylalane.

19F-NMR (C_6D_6): δ = -160.9 ppm (m, 4F,o-C_6F_5); -162.1 ppm (m, 2F, p-C_6F_5); -167.3 ppm (m, 4F, m-C_6F_5)

1H-NMR (C_6D_6): δ = 0.5 ppm (t, 3H, CH_3), 1.6 ppm (q, 2H, CH_2).

Example 3: Synthesis of bis(pentafluoroanilino)methylalane (3)

5.0 ml of trimethylaluminum (2.1 M in Exxol, 10.5 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 3.8 g (21.0 mmol) of pentafluoroaniline in 40 ml of toluene are added dropwise to this solution over a period of 30 minutes. The mixture is stirred for 15 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another two hours at room temperature. This results in a yellowish solution (0.13 M based on Al) of bis(pentafluoroanilino)methylalane.

19F-NMR (C_6D_6): δ = -162.9 ppm (m, 4F,o-C_6F_5); -164.1 ppm (m, 2F, p-C_6F_5); -171.3 ppm (m, 4F, m-C_6F_5)

1H-NMR (C_6D_6): δ = -0.4 ppm (t, 3H, CH_3), 5.6 ppm (s, 1H, NH).

Example 4: Synthesis of bis(bis(pentafluorophenyl)methoxy)methylalane **(4)**

5.0 ml of trimethylaluminum (2.1 M in Exxol, 10.5 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 7.6 g (21.0 mmol) of bis(pentafluorophenyl)carbinol in 40 ml of toluene are added dropwise to this solution over a period of 30 minutes. The mixture is stirred for 15 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another two hours at room temperature. This results in a yellowish solution (0.13 M based on Al) of bis(bis(pentafluorophenyl)methoxy)methylalane.

19F-NMR (C_6D_6): δ = -140.6 ppm (m, 4F, o-CH(C_6F_5)$_2$); -151.7 ppm (m, 2F, p-CH(C_6F_5)$_2$); -159.5 ppm (m, 4F, m-CH(C_6F_5)$_2$).

1H-NMR (C_6D_6): δ = 6.2 ppm (s, 1H, CH).

Example 5: Synthesis of bis(3,5 bis(trifluoromethyl)anilino)methylalane **(5)**

5.0 ml of trimethylaluminum (2.1 M in Exxol, 10.5 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 4.8 g (21.0 mmol) of 3,5-bis(trifluoromethyl)aniline in 40 ml of toluene are added dropwise to this solution over a period of 45 minutes. The mixture is stirred for 15 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another four hours at room temperature. The slightly turbid solution is filtered through a G4 frit. This results in a clear yellowish solution (0.13 M based on Al) of bis(3,5-bis(trifluoromethyl)anilino)methylalane.

19F-NMR (C_6D_6): δ = -61.5 ppm (s, 12F, CF_3).

1H-NMR (C_6D_6): δ = 5.5 ppm (s, 1H, NH), 6.3 ppm (s, 2H, Ar-H), 7.2 ppm (s, 1H, Ar-H).

Example 6: Synthesis of bis(nonafluorobiphenyloxy)methylalane (6)

5.0 ml of trimethylaluminum (2.1 M in Exxol, 10.5 mmol) together with 40 ml of toluene are placed in a reaction vessel and cooled to -40°C. 7.0 g (21.0 mmol) of nonafluorobiphenyl-1-ol in 40 ml of toluene are added dropwise to this solution over a period of 40 minutes. The mixture is stirred for 30 minutes at -40°C and the reaction solution is subsequently allowed to warm to room temperature. It is stirred for another one hour at room

temperature. The slightly turbid solution is filtered through a G4 frit. This results in a clear solution (0.13 M based on Al) of bis(nonafluorobiphenyloxy)methylalane.

19F-NMR (C_6D_6): δ = -134.0 ppm (m, 2F, 2,2'-F); -137.2 ppm (m, 2F, 3, 3'-F); -154.6 ppm (m, 2F, 4, 4'-F); 157.0 ppm (m, 1F, 6-F); 161.7 (m, 2F, 5, 5'-F).

1H-NMR (C_6D_6): δ = -0.3 ppm (s, 3H, CH_3).

General description of the preparation of the catalyst and the polymerization procedure

Preparation of the catalyst system:

1.25 ml of trimethylaluminum (2M in toluene) are added to a solution of 157 mg (250 µmol) of dimethylsilanediylbis(2-methyl-4-phenylindenyl)zirconium dichloride in 25 ml of toluene and the reaction solution is stirred at room temperature for 30 minutes. 2 equivalents of the appropriate cocatalyst compound (500 µmol) are subsequently added dropwise. The mixture is then stirred at room temperature for one hour. 10.0g of SiO_2 (XPO2107, dried at 600°C in a stream of argon) are added a little at a time to this solution. The mixture is stirred at RT for 30 minutes and the solvent is then removed in an oilpump vacuum. This results in a free-flowing powder. For introduction into the polymerization system, 1 g of the supported catalyst system is resuspended in 30 ml of Exxol.

Polymerization procedure:

In parallel thereto, a dry 16 dm^3 reactor is flushed firstly with nitrogen and subsequently with propylene and charged with 10 dm^3 of liquid propene. 0.5 cm^3 of a 20% strength triisobutylaluminum solution in Varsol diluted with 30 cm^3 of Exxol was then introduced into the reactor and the mixture was stirred at 30°C for 15 minutes. The catalyst suspension was subsequently introduced into the reactor. The reaction mixture was heated to the polymerization temperature of 60°C (4°C/min) and the polymerization system was maintained at 60°C for 1 hour by means of cooling. The polymerization was stopped by venting the remaining propylene. The polymer was dried in a drying oven.

Polymerization results

Catalyst system prepared from product from Example:	1	2	3	4	5	6
Amount of metallocene [mg]	157	157	157	157	157	157
Metallocene (µmol)	250	250	250	250	250	250
Cocatalyst (µmol)	500	500	500	500	500	500
SiO_2 weighed in [g]	10.0	10.0	10.0	10.0	10.0	10.0
SiO_2 weighed out [g]	10.19	10.20	10.18	10.35	10.22	10.30
Time (min)	60	60	60	60	60	60
PP (kg)	2.6	1.9	2.0	2.4	1.2	2.3
Activity [1]	156	124	130	158	78	151

1) Activity: kg of (PP) / g of metallocene x h

10/030299
JC13 Rec'd PCT/PTO 20 OCT 2001

We claim:

1. A compound of the formula (I),

$$[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k \qquad (I)$$

where

R^1, R^2 are identical or different and are each C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl or an $Si(R^4)_3$ group,

R^4 is C_1-C_{20}-haloalkyl, C_6-C_{20}-haloaryl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-haloalkylaryl,

R^3 is a hydrogen atom, a halogen atom, C_1-C_{20}-alkyl, C_1-C_{20}-haloalkyl, C_1-C_{10}-alkoxy, C_6-C_{20}-aryl, C_6-C_{20}-haloaryl, C_6-C_{20}-aryloxy, C_7-C_{40}-arylalkyl, C_7-C_{40}-haloarylalkyl, C_7-C_{40}-alkylaryl, C_7-C_{40}-haloalkylaryl or an $OSi(R^4)_3$ group,

X may be identical or different and are each an element of group VIa of the Periodic Table of the Elements or an NH group,

M^1 is an element of group IIIa of the Periodic Table of the Elements and

k is a natural number from 1 to 100, with the exception of $MeAl(OC_6F_5)_2$, $MeAl(OC_6F_4H)_2$ and $MeAl(O\text{-}2,6(C_6H_3Cl_2))_2$ [sic].

2. A process for preparing a compound of the formula (I) as claimed in claim 1, which comprises reacting one or more compounds of the formula (II)

$$(R^5)_3Y \qquad (II)$$

where

R^5 is a hydrogen atom or C_1-C_{20}-alkyl, C_6-C_{20}-aryl, C_7-C_{40}-arylalkyl, C_7-C_{40}-alkylaryl or a halogen atom, and

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Y is boron or aluminum,

with one or more compounds of the formula (III)

$(R^6)\ X'(R^1)$ (III)

where

R^1 is as defined under formula (I),

X' is an oxygen atom, a sulfur atom or an NH group, and

R^6 is hydrogen.

3. A catalyst system comprising

A) at least one chemical compound of the formula (I) $[(R^1)\text{-}X\text{-}M^1(R^3)\text{-}X\text{-}(R^2)]_k$ [sic], where R^1, R^2, R^3, x, M^1 and k are each as defined in claim 1, and

B) at least one transition metal compound which constitutes a metallocene compound, a diamine complex of transition groups III and IV of the Periodic Table of the Elements, a diimine complex of transition group VIII of the Periodic Table of the Elements or a 2,6-bis(imino)pyridine complex of transition group VIII of the Periodic Table of the Elements.

4. A catalyst system as claimed in claim 3 which further comprises a support.

5. A process for preparing a polyolfin in the presence of a catalyst system as claimed in claim 3 or 4.

6. The use of a catalyst system as claimed in claim 3 or 4 for the polymerization of olefins.

COMBINED DECLARATION AND POWER OF ATTORNEY	Attorney Docket No. Basell-4 (9086*178)

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

CHEMICAL COMPOUND, ITS PREPARATION AND ITS USE IN A CATALYST SYSTEM FOR PREPARING POLYOLEFINS

the specification of which

(check one) ☐ is attached hereto.

☒ was filed as PCT international application Number PCT/EP00/03315 on April 13, 2000.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, ' 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. ' 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or ' 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s) — Priority Claimed

(Number)	(Country)	(Day/Month/Year Filed)	No	yes
199 17 984.0	Germany	21 April 1999	☐	☒
			☐	☐

No

I hereby claim the benefit under 35 U.S.C. ' 119(e) of any United States provisional application(s) listed below.

(Application No)	(filing date)

I hereby claim the benefit under Title 35, United States Code, ' 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, ' 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, ' 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
PCT/EP00/03315	13 April 2000	Published (WO 00/64906)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

In the matter of the above-identified application, please recognize the attorneys associated with **CUSTOMER NUMBER 23416**; all of CONNOLLY BOVE LODGE & HUTZ LLP, as attorneys with full power of substitution to prosecute this application and conduct all business in the Patent and Trademark Office connected therewith.

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